



SEQUENCE LISTING

<110> THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
FAN, Hung Y.
PALMARINI, Massimo
SHARP, James M.

<120> A LUNG CANCER ASSOCIATED RETROVIRUS, GENE DELIVERY VECTOR AND
METHODS OF USE THEREOF

<130> UCI1150-1

<140> US 10/030,441
<141> 2002-05-16

<150> PCT/US 00/18856
<151> 2000-07-08

<150> US 60/142,868
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<170> PatentIn version 3.1

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Pro Pro Pro Ser Lys His Met Ser Pro Leu Gln Arg Ala Leu Arg Gln
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Ile Gln Tyr
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Met Leu Lys His Arg Gly Ile Thr Val Ser Lys Thr Lys Leu Ile Asn
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Thr Val Asn Leu Glu Thr Trp Lys Lys Val Gly Glu Gln Ile Arg Thr
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His Tyr Thr Leu His Gly Pro Glu Lys Val Pro Val Glu Thr Leu Ser
 65 70 75 80

Phe Trp Thr Leu Ile Arg Asp Cys Leu Asp Phe Asp Asn Asp Glu Leu
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Lys Arg Leu Gly Asn Leu Leu Lys Gln Glu Glu Asp Pro Leu His Thr
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Pro Asp Ser Val Pro Ser Tyr Asp Pro Pro Pro Pro Pro Pro Ser
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Leu Lys Met His Pro Ser Asp Asn Asp Asp Ser Leu Ser Ser Thr Asp
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Pro Pro Asn Asp Trp Lys Gln Thr Ala Arg Ala Cys Leu Ser Gly Gly
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Asp Tyr Leu Leu Trp Lys Ser Glu Phe Phe Glu Gln Cys Ala Arg Ile
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Gln Gly Pro Asp Glu Pro Tyr Gln Asp Phe Val Ala Arg Leu Leu Asp
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Asn Lys Lys Gly Leu Gln Lys Ser Gly Asn Ser Gly Cys Phe Val Cys
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Gly Gln Pro Gly His Arg Ala Ala Val Cys Pro Gln Lys His Gln Thr

515

520

525

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Pro Pro Val Ser Gly Asn Trp Val Arg Gly Gln Pro Leu Ala Pro Lys
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Gln Cys Tyr Gly Ala Thr Leu Gln Val Pro Lys Glu Pro Leu Gln Thr
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Pro Ile Gln Tyr
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Met Leu Lys His Arg Gly Ile Thr Val Ser Lys Pro Lys Leu Ile Asn
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Phe Leu Ser Phe Ile Glu Glu Val Cys Pro Trp Phe Pro Arg Glu Gly
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Thr Val Asn Leu Glu Thr Trp Lys Lys Val Gly Glu Gln Ile Arg Thr
 50 55 60

His Tyr Thr Leu His Gly Pro Glu Lys Val Pro Val Glu Thr Leu Ser
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Phe Trp Thr Leu Ile Arg Asp Cys Leu Asp Phe Asp Asn Asp Glu Leu
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Lys Arg Leu Gly Asn Leu Leu Lys Gln Glu Glu Asp Pro Leu His Asp
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Pro Asp Ser Glu Asn Ser Tyr Asp Ala Pro Pro Pro Pro His Pro Ser
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Leu His Ser Ser Arg Pro Ser Asp Asn Asp Asp Leu Leu Ser Ser Thr
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Asp Glu Ala Glu Leu Asp Glu Glu Ala Ala Lys Tyr His Gln Glu Asp
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Pro Pro Ala Tyr Ala Pro Ser Val Val Ala Gly Leu Asp Pro Pro Pro
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Leu Pro Gly Ala Tyr Ala Gln Ile Ser Asn Ala Ala Arg Gln Ala Trp
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Lys Lys Leu Pro Ser Ser Thr Lys Thr Glu Asp Leu Ser Lys Val
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Arg Gln Gly Pro Asp Glu Pro Tyr Gln Asp Phe Val Ala Arg Leu Leu
 405 410 415

Asp Thr Ile Gly Lys Ile Met Ser Asp Glu Lys Ala Gly Met Val Leu
 420 425 430

Ala Lys Gln Leu Ala Phe Glu Asn Ala Asn Ser Ala Cys Gln Ala Ala
 435 440 445

Leu Arg Pro Tyr Arg Lys Lys Gly Asp Leu Ser Asp Phe Ile Arg Ile
 450 455 460

Cys Ala Asp Ile Gly Pro Ser Tyr Met Gln Gly Ile Ala Met Ala Ala
 465 470 475 480

Ala Leu Gln Gly Lys Ser Ile Lys Glu Val Leu Phe Gln Gln Gln Ala
 485 490 495

Arg Asn Lys Arg Gly Arg Gln Arg Ser Gly Asn Ser Gly Cys Phe Val
 500 505 510

Cys Gly Gln Pro Gly His Arg Ala Ala Val Cys Pro Gln Lys Gln Gln
 515 520 525

Ser Pro Val Asn Thr Pro Asn Leu Cys Pro Arg Cys Lys Lys Gly Lys
 530 535 540

His Trp Ala Arg Asp Cys Arg Ser Lys Thr Asp Val Gln Gly Thr Pro
 545 550 555 560

Leu Pro Pro Val Ser Gly Asn Trp Val Arg Gly Gln Pro Leu Ala Pro
 565 570 575

Lys Gln Cys Tyr Gly Ala Thr Leu Gln Val Pro Lys Glu Pro Leu Gln
 580 585 590

Thr Ser Val Glu Pro Gln Glu Ala Ala Arg Asp Trp Thr Ser Val Pro

595

600

605

Pro Pro Thr Gln Tyr
 610

<210> 12
 <211> 616
 <212> PRT
 <213> Artificial sequence

<220>
 <223> Derived from JSRVenv

<400> 12

Met Gly Gln Thr His Ser Arg Gln Leu Phe Val His Met Leu Ser Val
 1 5 10 15

Met Leu Lys His Arg Gly Ile Thr Val Ser Lys Pro Lys Leu Ile Asn
 20 25 30

Phe Leu Ser Phe Ile Glu Glu Val Cys Pro Trp Phe Pro Arg Glu Gly
 35 40 45

Thr Val Asn Leu Glu Thr Trp Lys Lys Val Gly Glu Gln Ile Arg Thr
 50 55 60

His Tyr Thr Leu His Gly Pro Glu Lys Ile Pro Val Glu Thr Leu Ser
 65 70 75 80

Phe Trp Thr Leu Ile Arg Asp Cys Leu Asp Phe Asp Asn Asp Glu Leu
 85 90 95

Lys Arg Leu Gly Asn Leu Leu Lys Gln Glu Glu Asp Pro Leu His Val
 100 105 110

Pro Asp Ser Glu Pro Arg Tyr Ala Val Pro Glu Gly Val Lys Ser Asp
 115 120 125

Pro Pro Phe Ser Asn Leu Leu His Pro Ser Asp Asn Asp Asp Leu Leu
 130 135 140

Ser Ser Thr Asp Glu Ala Glu Leu Asp Glu Glu Ala Ala Lys Tyr His
 145 150 155 160

Gln Glu Asp Trp Gly Phe Leu Ala Gln Glu Lys Gly Ala Leu Thr Ser
 165 170 175

Lys Asp Glu Leu Val Glu Cys Phe Lys Asn Leu Thr Ile Ala Leu Gln
 180 185 190

Asn Ala Gly Ile Lys Leu Pro Ser Asn Asn Ala Lys Ser Pro Ser Ala
 195 200 205

Pro Pro Leu Pro Pro Ala Tyr Ala Pro Ser Val Val Ala Gly Leu Asp
 210 215 220

Pro Pro Pro Gly Pro Pro Pro Ser Glu Asn Met Ser Pro Leu Gln
 225 230 235 240

Lys Ala Leu Arg Gln Ala Gln Arg Leu Gly Glu Val Val Ser Asp Phe
 245 250 255

Ser Leu Ala Phe Pro Val Phe Glu Asn Asn Asn Gln Arg Tyr Tyr Glu
 260 265 270

Ser Leu Pro Phe Lys Gln Leu Lys Glu Leu Lys Ile Ala Cys Ser Gln
 275 280 285

Tyr Gly Pro Thr Ala Pro Phe Thr Ile Ala Met Ile Glu Asn Leu Gly
 290 295 300

Thr Gln Ala Leu Pro Pro Asn Asp Trp Lys Gln Thr Ala Arg Ala Cys
 305 310 315 320

Leu Ser Gly Gly Asp Tyr Leu Leu Trp Lys Ser Glu Phe Phe Glu Gln
 325 330 335

Cys Ala His Ile Ala Asp Val Asn Arg Gln Gln Gly Ile Gln Thr Ser
 340 345 350

Tyr Glu Met Leu Ile Gly Glu Gly Pro Tyr Gln Ala Thr Asp Thr Gln
 355 360 365

Leu Asn Phe Leu Pro Gly Ala Tyr Ala Gln Ile Ser Asn Ala Ala Arg
 370 375 380

Gln Ala Trp Lys Lys Leu Pro Ser Ser Ser Thr Lys Thr Glu Asp Leu
 385 390 395 400

Ser Lys Val Arg Gln Gly Pro Asp Glu Pro Tyr Gln Asp Phe Val Ala
 405 410 415

Arg Leu Leu Asp Thr Ile Gly Lys Ile Met Ser Asp Glu Lys Ala Gly

420

425

430

Met Val Leu Ala Lys Gln Leu Ala Phe Glu Asn Ala Asn Ser Ala Cys
 435 440 445

Gln Ala Ala Leu Arg Pro Tyr Arg Lys Lys Gly Asp Leu Ser Asp Phe
 450 455 460

Ile Arg Ile Cys Ala Asp Ile Gly Pro Ser Tyr Met Gln Gly Ile Ala
 465 470 475 480

Met Ala Ala Ala Leu Gln Gly Lys Ser Ile Lys Glu Val Leu Phe Gln
 485 490 495

Gln Gln Ala Arg Asn Lys Lys Gly Leu Gln Lys Ser Gly Asn Leu Gly
 500 505 510

Cys Phe Val Cys Gly Gln Pro Gly His Arg Ala Ala Val Cys Pro Gln
 515 520 525

Lys Gln Gln Ser Pro Val Asn Thr Pro Asn Leu Cys Pro Arg Cys Lys
 530 535 540

Lys Gly Lys His Trp Ala Arg Asp Cys Arg Ser Lys Thr Asp Val Gln
 545 550 555 560

Gly Asn Pro Leu Pro Pro Val Ser Gly Asn Trp Val Arg Gly Gln Pro
 565 570 575

Leu Ala Pro Lys Gln Cys Tyr Gly Ala Thr Leu Gln Val Pro Lys Gly
 580 585 590

Pro Leu Gln Thr Ser Val Glu Pro Gln Glu Ala Ala Arg Asp Trp Thr
 595 600 605

Ser Val Pro Pro Pro Thr Gln Tyr
 610 615

<210> 13
 <211> 616
 <212> PRT
 <213> Artificial sequence

<220>
 <223> Derived from JSRVenv

<400> 13

Met Gly Gln Thr His Ser Arg Gln Leu Phe Val His Met Leu Ser Val
 1 5 10 15

Met Leu Lys His Trp Gly Ile Thr Val Ser Lys Pro Lys Leu Ile Asn
 20 25 30

Phe Leu Ser Phe Ile Glu Glu Val Cys Pro Trp Phe Pro Arg Glu Gly
 35 40 45

Thr Val Asn Leu Glu Thr Trp Lys Lys Val Gly Glu Gln Ile Arg Thr
 50 55 60

His Tyr Thr Leu His Gly Pro Glu Lys Ile Pro Val Glu Thr Leu Ser
 65 70 75 80

Phe Trp Thr Leu Ile Arg Asp Cys Leu Asp Phe Asp Asn Asp Glu Leu
 85 90 95

Lys Cys Leu Gly Asn Val Leu Lys Gln Glu Glu Asp Pro Leu His Val
 100 105 110

Pro Asp Ser Glu Pro Arg Tyr Ala Val Pro Glu Gly Val Lys Ser Asp
 115 120 125

Pro Pro Phe Ser Asn Leu Leu Arg Pro Ser Asp Asn Asp Asp Leu Leu
 130 135 140

Ser Ser Thr Asp Glu Ala Glu Leu Asp Glu Glu Ala Ala Lys Tyr His
 145 150 155 160

Gln Glu Asp Trp Gly Phe Leu Ala Gln Glu Lys Gly Ala Leu Thr Ser
 165 170 175

Lys Val Glu Leu Val Glu Cys Phe Lys Asn Leu Thr Ile Ala Leu Gln
 180 185 190

Asn Ala Gly Ile Lys Leu Pro Ser Asn Asn Ala Lys Ser Pro Ser Ala
 195 200 205

Pro Pro Leu Pro Pro Ala Tyr Ala Pro Ser Val Val Ala Gly Leu Asp
 210 215 220

Pro Pro Pro Gly Pro Pro Pro Ser Glu Asn Met Ser Pro Leu Gln
 225 230 235 240

Lys Ala Leu Arg Gln Ala Gln Arg Leu Gly Glu Val Val Ser Asp Phe

245

250

255

Ser Leu Ala Phe Pro Val Phe Glu Asn Asn Asn Gln Arg Tyr Tyr Glu
 260 265 270

Ser Leu Pro Phe Lys Gln Leu Lys Glu Leu Lys Ile Ala Cys Ser Gln
 275 280 285

Tyr Gly Pro Thr Ala Pro Phe Thr Ile Ala Met Ile Glu Asn Leu Gly
 290 295 300

Thr Gln Ala Leu Pro Pro Asn Asp Trp Lys Gln Thr Ala Arg Ala Phe
 305 310 315 320

Leu Ser Gly Gly Asp Tyr Leu Leu Trp Lys Ser Glu Phe Phe Glu Gln
 325 330 335

Cys Ala Arg Ile Ala Asp Val Asn Arg Gln Gln Gly Ile Gln Thr Ser
 340 345 350

Tyr Glu Met Leu Ile Gly Glu Gly Pro Tyr Gln Ala Thr Asp Thr Gln
 355 360 365

Leu Asn Phe Leu Pro Gly Ala Tyr Ala Gln Ile Ser Asn Ala Ala Arg
 370 375 380

Gln Ala Trp Lys Lys Leu Pro Ser Ser Ser Thr Lys Thr Glu Asp Leu
 385 390 395 400

Ser Lys Val Arg Gln Gly Pro Asp Glu Pro Tyr Gln Asp Phe Val Ala
 405 410 415

Arg Leu Leu Asp Thr Ile Gly Lys Ile Met Ser Asp Glu Gln Ala Gly
 420 425 430

Met Val Leu Ala Lys Gln Leu Ala Phe Glu Asn Ala Asn Ala Cys
 435 440 445

Gln Ala Ala Leu Arg Pro Tyr Arg Lys Lys Gly Asp Leu Ser Asp Phe
 450 455 460

Ile Arg Ile Cys Ala Asp Ile Gly Pro Ser Tyr Met Gln Gly Ile Ala
 465 470 475 480

Met Ala Ala Ala Leu Gln Gly Lys Ser Ile Lys Glu Val Leu Phe Gln
 485 490 495

Gln Gln Ala Arg Asn Lys Lys Gly Leu Gln Lys Ser Gly Asn Ser Gly
 500 505 510

Cys Phe Val Cys Gly Gln Pro Gly His Arg Ala Ala Val Cys Pro Gln
 515 520 525

Lys Gln Gln Ser Pro Val Asn Thr Pro Asn Leu Cys Pro Arg Cys Lys
 530 535 540

Lys Gly Lys His Trp Ala Arg Asp Cys His Ser Lys Thr Asp Val Gln
 545 550 555 560

Gly Asn Pro Leu Pro Pro Val Ser Gly Asn Trp Val Arg Gly Gln Pro
 565 570 575

Leu Ala Pro Lys Gln Cys Tyr Gly Ala Thr Leu Gln Val Pro Lys Gly
 580 585 590

Pro Leu Gln Thr Ser Val Glu Pro Gln Glu Ala Ala Arg Asp Trp Thr
 595 600 605

Ser Val Pro Pro Pro Thr Gln Tyr
 610 615

<210> 14
 <211> 615
 <212> PRT
 <213> Ovine pulmonary adenocarcinoma virus

<400> 14

Met Pro Lys Arg Arg Ala Gly Phe Arg Lys Gly Trp Tyr Ala Arg Gln
 1 5 10 15

Arg Asn Ser Leu Thr His Gln Met Gln Arg Met Thr Leu Ser Glu Pro
 20 25 30

Thr Ser Glu Leu Pro Thr Gln Arg Gln Ile Glu Ala Leu Met Arg Tyr
 35 40 45

Ala Trp Asn Glu Ala His Val Gln Pro Pro Val Thr Pro Thr Asn Ile
 50 55 60

Leu Ile Met Leu Leu Leu Leu Gln Arg Val Gln Asn Gly Ala Ala
 65 70 75 80

Ala Ala Phe Trp Ala Tyr Ile Pro Asp Pro Pro Met Ile Gln Ser Leu
 85 90 95

Gly Trp Asp Arg Glu Ile Val Pro Val Tyr Val Asn Asp Thr Ser Leu
 100 105 110

Leu Gly Gly Lys Ser Asp Ile His Ile Ser Pro Gln Gln Ala Asn Ile
 115 120 125

Ser Phe Tyr Gly Leu Thr Thr Gln Tyr Pro Met Cys Phe Ser Tyr Gln
 130 135 140

Ser Gln His Pro His Cys Ile Gln Val Ser Ala Asp Ile Ser Tyr Pro
 145 150 155 160

Arg Val Thr Ile Ser Gly Ile Asp Glu Lys Thr Gly Lys Lys Ser Tyr
 165 170 175

Gly Asn Gly Ser Gly Pro Leu Asp Ile Pro Phe Cys Asp Lys His Leu
 180 185 190

Ser Ile Gly Ile Gly Ile Asp Thr Pro Trp Thr Leu Cys Arg Ala Arg
 195 200 205

Val Ala Ser Val Tyr Asn Ile Asn Asn Ala Asn Ala Thr Phe Leu Trp
 210 215 220

Asp Trp Ala Pro Gly Gly Thr Pro Asp Phe Pro Glu Tyr Arg Gly Gln
 225 230 235 240

His Pro Pro Ile Phe Ser Val Asn Thr Ala Pro Ile Tyr Gln Thr Glu
 245 250 255

Leu Trp Lys Leu Leu Ala Ala Phe Gly His Gly Asn Ser Leu Tyr Leu
 260 265 270

Gln Pro Asn Ile Ser Gly Ser Lys Tyr Gly Asp Val Gly Val Thr Gly
 275 280 285

Phe Leu Tyr Pro Arg Ala Cys Val Pro Tyr Pro Phe Met Leu Ile Gln
 290 295 300

Gly His Met Glu Ile Thr Leu Ser Leu Asn Ile Tyr His Leu Asn Cys
 305 310 315 320

Ser Asn Cys Ile Leu Thr Asn Cys Ile Arg Gly Val Ala Lys Gly Glu

325

330

335

Gln Val Ile Ile Val Lys Gln Pro Ala Phe Val Met Leu Pro Val Glu
 340 345 350

Ile Ala Glu Ala Trp Tyr Asp Glu Thr Ala Leu Glu Leu Leu Gln Arg
 355 360 365

Ile Asn Thr Ala Leu Ser Arg Pro Lys Arg Gly Leu Ser Leu Ile Ile
 370 375 380

Leu Gly Ile Val Ser Leu Ile Thr Leu Ile Ala Thr Ala Val Thr Ala
 385 390 395 400

Ser Val Ser Leu Ala Gln Ser Ile Gln Ala Ala His Thr Val Asp Ser
 405 410 415

Leu Ser Tyr Asn Val Thr Lys Val Met Gly Thr Gln Glu Asp Ile Asp
 420 425 430

Lys Lys Ile Glu Asp Arg Leu Ser Ala Leu Tyr Asp Val Val Arg Val
 435 440 445

Leu Gly Glu Gln Val Gln Ser Ile Asn Phe Arg Met Lys Ile Gln Cys
 450 455 460

His Ala Asn Tyr Lys Trp Ile Cys Val Thr Lys Lys Pro Tyr Asn Thr
 465 470 475 480

Ser Asp Phe Pro Trp Asp Lys Val Lys Lys His Leu Gln Gly Ile Trp
 485 490 495

Phe Asn Thr Asn Leu Ser Leu Asp Leu Leu Gln Leu His Asn Glu Ile
 500 505 510

Leu Asp Ile Glu Asn Ser Pro Lys Ala Thr Leu Asn Ile Ala Asp Thr
 515 520 525

Val Asp Asn Phe Leu Gln Asn Leu Phe Ser Asn Phe Pro Ser Leu His
 530 535 540

Ser Leu Trp Lys Thr Leu Ile Gly Val Gly Ile Leu Val Phe Ile Ile
 545 550 555 560

Ile Val Val Ile Leu Ile Phe Pro Cys Leu Val Arg Gly Met Val Arg
 565 570 575

Asp Phe Leu Lys Met Arg Val Glu Met Leu His Met Lys Tyr Arg Asn
 580 585 590

Met Leu Gln His Gln His Leu Met Glu Leu Leu Lys Asn Lys Glu Arg
 595 600 605

Gly Asp Ala Gly Asp Asp Pro
 610 615

<210> 15
 <211> 615
 <212> PRT

<213> Ovine pulmonary adenocarcinoma virus

<400> 15

Met Pro Lys Arg Arg Ala Gly Phe Arg Lys Gly Trp Tyr Ala Arg Gln
 1 5 10 15

Arg Asn Ser Leu Thr His Gln Met Gln Arg Met Thr Leu Ser Glu Pro
 20 25 30

Thr Ser Glu Leu Pro Thr Gln Arg Gln Ile Glu Ala Leu Met Pro Tyr
 35 40 45

Ala Trp Asn Glu Ala His Val Gln Pro Pro Val Thr Pro Thr Asn Ile
 50 55 60

Leu Ile Met Leu Leu Leu Leu Gln Arg Val Gln Asn Gly Ala Ala
 65 70 75 80

Ala Ala Phe Trp Ala Tyr Ile Pro Asp Pro Pro Met Ile Gln Ser Leu
 85 90 95

Gly Trp Asp Arg Glu Ile Val Pro Val Tyr Val Asn Asp Thr Ser Leu
 100 105 110

Leu Gly Gly Lys Ser Asp Ile His Ile Ser Pro Gln Gln Ala Asn Ile
 115 120 125

Ser Phe Tyr Gly Leu Thr Thr Gln Tyr Pro Met Cys Phe Ser Tyr Gln
 130 135 140

Ser Gln His Pro His Cys Ile Gln Val Ser Ala Asp Ile Ser Tyr Pro
 145 150 155 160

Arg Val Thr Ile Ser Gly Ile Asp Glu Lys Thr Gly Lys Lys Ser Tyr
 165 170 175

Gly Asn Gly Thr Gly Pro Leu Asp Ile Pro Phe Cys Asp Lys His Leu
 180 185 190

Ser Ile Gly Ile Gly Ile Asp Thr Pro Trp Thr Leu Cys Arg Ala Arg
 195 200 205

Val Ala Ser Val Tyr Asn Ile Asn Asn Ala Asn Ala Thr Phe Leu Trp
 210 215 220

Asp Trp Ala Pro Gly Gly Thr Pro Asp Phe Pro Glu Tyr Arg Gly Gln
 225 230 235 240

His Pro Pro Ile Phe Ser Val Asn Thr Ala Pro Ile Tyr Gln Thr Glu
 245 250 255

Leu Trp Lys Leu Leu Ala Ala Phe Gly His Gly Asn Ser Leu Tyr Leu
 260 265 270

Gln Pro Asn Ile Ser Gly Thr Lys Tyr Gly Asp Val Gly Val Thr Gly
 275 280 285

Phe Leu Tyr Pro Arg Ala Cys Val Pro Tyr Pro Phe Met Leu Ile Gln
 290 295 300

Gly His Met Glu Ile Thr Leu Ser Leu Asn Ile Tyr His Leu Asn Cys
 305 310 315 320

Ser Asn Cys Ile Leu Thr Asn Cys Ile Arg Gly Val Ala Lys Gly Glu
 325 330 335

Gln Val Ile Ile Val Lys Gln Pro Ala Phe Val Met Leu Pro Val Glu
 340 345 350

Ile Ala Glu Ala Trp Tyr Asp Glu Thr Ala Leu Glu Leu Leu Gln Arg
 355 360 365

Ile Asn Thr Ala Leu Ser Arg Pro Lys Arg Gly Leu Ser Leu Ile Ile
 370 375 380

Leu Gly Ile Val Ser Leu Ile Thr Leu Ile Ala Thr Ala Val Thr Ala
 385 390 395 400

Cys Val Ser Leu Ala Gln Ser Ile Gln Ala Ala His Thr Val Asp Ser

405

410

415

Leu Ser Tyr Asn Val Thr Lys Val Met Gly Thr Gln Glu Asp Ile Asp
 420 425 430

Lys Lys Ile Glu Asp Arg Leu Ser Ala Leu Tyr Asp Val Val Arg Val
 435 440 445

Leu Gly Glu Gln Val Gln Ser Ile Asn Phe Arg Met Lys Ile Gln Cys
 450 455 460

His Ala Asn Tyr Lys Trp Ile Cys Val Thr Lys Lys Pro Tyr Asn Thr
 465 470 475 480

Ser Asp Phe Pro Trp Asp Lys Val Lys Lys His Leu Gln Gly Ile Trp
 485 490 495

Phe Asn Thr Asn Leu Ser Leu Asp Leu Leu Gln Leu His Asn Glu Ile
 500 505 510

Leu Asp Ile Glu Asn Ser Pro Lys Ala Thr Leu Asn Ile Ala Asp Thr
 515 520 525

Val Asp Asn Phe Leu Gln Asn Leu Phe Ser Asn Phe Pro Ser Leu His
 530 535 540

Ser Leu Trp Lys Thr Leu Ile Gly Leu Gly Ile Phe Val Ile Ile Ile
 545 550 555 560

Ala Ile Val Ile Phe Val Phe Pro Cys Val Val Arg Gly Leu Val Arg
 565 570 575

Asp Phe Leu Lys Met Arg Val Glu Met Leu His Met Lys Tyr Arg Thr
 580 585 590

Met Leu Gln His Arg His Leu Met Glu Leu Leu Lys Asn Lys Glu Arg
 595 600 605

Gly Ala Ala Gly Asp Asp Pro
 610 615

<210> 16
 <211> 617
 <212> PRT
 <213> Ovine enzootic nasal tumour virus

<400> 16

Met Pro Lys His Arg Ala Gly Phe Arg Lys Gly Trp Tyr Ala Arg Gln
 1 5 10 15

Arg Asn Ser Leu Thr Tyr Gln Met Gln Arg Met Thr Leu Asn Glu Thr
 20 25 30

Thr Asn Gly Leu Pro Thr Gln Arg Gln Val Glu Ala Leu Met Arg His
 35 40 45

Ala Trp Asn Glu Ala His Val Gln Pro Pro Ala Thr Pro Ile Lys Ile
 50 55 60

Leu Ile Met Leu Leu Leu Leu Gln Arg Ile Gln Asn Gly Ala Ala
 65 70 75 80

Ala Ala Phe Trp Ala Tyr Ile Pro Asp Pro Pro Met Ile Gln Ser Leu
 85 90 95

Gly Trp Asp Arg Glu Ile Val Pro Val Tyr Val Asn Asp Thr Ser Leu
 100 105 110

Leu Gly Gly Lys Ser Asp Ile His Ile Ser Pro Gln Gln Ala Asn Ile
 115 120 125

Ser Phe Tyr Gly Leu Thr Thr Gln Tyr Pro Met Cys Phe Ser Tyr Gln
 130 135 140

Ser Gln His Pro His Cys Ile Gln Val Ser Ala Asp Ile Ser Tyr Pro
 145 150 155 160

Arg Val Thr Ile Ser Gly Ile Asp Glu Lys Thr Gly Lys Arg Ser Tyr
 165 170 175

Arg Asn Gly Thr Gly Pro Leu Asp Ile Pro Phe Cys Asp Lys Asn Leu
 180 185 190

Ser Ile Ser Ile Gly Ile Asp Thr Pro Trp Thr Leu Cys Arg Ala Arg
 195 200 205

Ile Ala Ser Val Tyr Asn Ile Asn Asn Ala Asn Thr Thr Leu Leu Trp
 210 215 220

Asp Trp Ala Pro Gly Gly Thr Pro Asp Phe Pro Glu Tyr Arg Gly Gln
 225 230 235 240

His Pro Pro Ile Leu Ser Val Asn Thr Ala Pro Ile Phe Gln Thr Glu
 245 250 255

Leu Trp Lys Leu Leu Ala Ala Phe Gly His Gly Asn Ser Leu Tyr Leu
 260 265 270

Gln Pro Asn Ile Ser Gly Ser Lys Tyr Gly Asp Val Gly Val Thr Gly
 275 280 285

Phe Leu Tyr Pro Arg Ala Cys Val Pro Tyr Pro Phe Met Leu Ile Gln
 290 295 300

Gly His Met Glu Ile Thr Leu Ser Leu Asn Ile Tyr His Leu Asn Cys
 305 310 315 320

Ser Asn Cys Ile Leu Thr Asn Cys Ile Arg Gly Val Ala Lys Gly Glu
 325 330 335

Gln Val Ile Ile Val Lys Gln Pro Ala Phe Val Met Leu Pro Val Glu
 340 345 350

Ile Thr Glu Glu Trp Tyr Asp Glu Thr Ala Leu Glu Leu Leu Gln Arg
 355 360 365

Ile Asn Thr Ala Leu Ser Arg Pro Lys Arg Gly Leu Ser Leu Ile Ile
 370 375 380

Leu Gly Ile Val Ser Leu Ile Thr Leu Ile Ala Thr Ala Val Thr Ala
 385 390 395 400

Ser Val Ser Leu Ala Gln Ser Ile Gln Ala Ala His Thr Val Asp Ser
 405 410 415

Leu Ser Tyr Asn Val Thr Lys Val Met Gly Thr Gln Glu Asp Ile Asp
 420 425 430

Lys Lys Ile Glu Asp Arg Leu Ser Ala Leu Tyr Asp Val Val Arg Val
 435 440 445

Leu Gly Glu Gln Val Gln Ser Ile Asn Phe Arg Met Lys Ile Gln Cys
 450 455 460

His Ala Asn Tyr Lys Trp Ile Cys Val Thr Lys Lys Pro Tyr Asn Thr
 465 470 475 480

Ser Asp Tyr Pro Trp Asp Lys Val Glu Lys His Leu Gln Gly Ile Trp

485

490

495

Phe Asn Thr Asn Val Ser Leu Asp Leu Leu Gln Leu His Asn Glu Ile
 500 505 510

Leu Asp Ile Glu Asn Ser Pro Lys Ala Thr Leu Asn Ile Ala Asp Thr
 515 520 525

Val Asn Asn Phe Leu Gln Asn Leu Phe Ser Asn Phe Pro Ser Leu His
 530 535 540

Ser Leu Trp Gln Ser Ile Ile Val Ile Ala Ile Ile Val Phe Ile Val
 545 550 555 560

Ile Val Val Ile Leu Leu Val Pro Cys Leu Thr Arg Gly Leu Ile Lys
 565 570 575

Asp Phe Leu Gln Met Arg Ile Glu Leu Ile His Met Lys Tyr Arg Tyr
 580 585 590

Met Leu Gln Tyr Gln Lys Leu Met Asp Phe Val Lys Lys Arg Glu Gly
 595 600 605

Ser Cys Gly Gly Gln Pro Ala Glu Gly
 610 615

<210> 17
 <211> 611
 <212> PRT
 <213> Ovis aries

<400> 17

Met Pro Lys Arg Arg Ala Gly Phe Arg Lys Gly Trp Tyr Ala Arg Gln
 1 5 10 15

Arg Asn Ser Leu Thr His Gln Met Gln Arg Met Thr Leu Ser Glu Pro
 20 25 30

Thr Ser Glu Leu Pro Thr Gln Arg Gln Ile Glu Ala Leu Met Arg Tyr
 35 40 45

Ala Trp Asn Glu Ala His Val Gln Pro Pro Val Thr Pro Thr Asn Ile
 50 55 60

Leu Ile Met Leu Leu Leu Leu Gln Arg Ile Gln Asn Gly Ala Ala
 65 70 75 80

Ala Ala Phe Trp Ala Tyr Ile Pro Asp Pro Pro Met Ile Gln Ser Leu
 85 90 95

Gly Trp Asp Lys Glu Thr Val Pro Val Tyr Val Asn Asp Thr Ser Leu
 100 105 110

Leu Gly Gly Lys Ser Asp Ile His Ile Ser Pro Gln Gln Ala Asn Ile
 115 120 125

Ser Phe Tyr Gly Leu Thr Thr Gln Tyr Pro Met Cys Phe Ser Tyr Gln
 130 135 140

Ser Gln His Pro His Cys Ile Gln Val Ser Ala Asp Ile Ser Tyr Pro
 145 150 155 160

Arg Val Thr Ile Ser Gly Ile Asp Glu Lys Thr Gly Lys Arg Ser Tyr
 165 170 175

Arg Asp Gly Thr Gly Pro Leu Asp Ile Pro Phe Cys Asp Lys His Leu
 180 185 190

Ser Ile Gly Ile Gly Ile Asp Thr Pro Trp Thr Leu Cys Arg Ala Pro
 195 200 205

Ile Ala Ser Val Tyr Asn Ile Asn Asn Ala Asn Thr Thr Leu Leu Trp
 210 215 220

Asp Trp Ala Pro Gly Gly Thr Pro Asp Phe Pro Glu Tyr Arg Gly Gln
 225 230 235 240

His Pro Pro Ile Phe Ser Val Asn Thr Ala Pro Ile Tyr Gln Thr Glu
 245 250 255

Leu Trp Lys Leu Leu Ala Ala Phe Gly His Gly Asn Ser Leu Tyr Leu
 260 265 270

Gln Pro Asn Ile Ser Gly Ser Lys Tyr Gly Asp Val Gly Val Thr Gly
 275 280 285

Phe Leu Tyr Pro Arg Ala Cys Val Pro Tyr Pro Phe Met Leu Ile Gln
 290 295 300

Gly His Met Glu Ile Thr Leu Ser Leu Asn Ile Tyr His Leu Asn Cys
 305 310 315 320

Ser Asn Cys Ile Leu Thr Asn Cys Ile Arg Gly Val Ala Lys Gly Glu
 325 330 335

Gln Val Ile Ile Val Lys Gln Pro Ala Phe Val Met Leu Pro Val Glu
 340 345 350

Ile Thr Glu Glu Trp Tyr Asp Glu Thr Ala Leu Glu Leu Leu Gln Arg
 355 360 365

Ile Asn Thr Ala Leu Ser Arg Pro Lys Arg Gly Leu Ser Leu Ile Ile
 370 375 380

Leu Gly Ile Val Ser Leu Ile Thr Leu Ile Ala Thr Ala Val Thr Ala
 385 390 395 400

Ser Val Ser Leu Ala Gln Ser Ile Gln Ala Ala His Thr Val Asp Ser
 405 410 415

Leu Ser Ser Asn Val Thr Lys Val Met Gly Thr Gln Glu Asn Ile Asp
 420 425 430

Lys Lys Ile Glu Asp Arg Leu Ser Ala Leu Tyr Asp Val Val Arg Val
 435 440 445

Leu Gly Glu Gln Val Gln Ser Ile Asn Phe Arg Met Lys Ile Gln Cys
 450 455 460

His Ala Asn Tyr Lys Trp Ile Cys Val Thr Lys Lys Pro Tyr Asn Thr
 465 470 475 480

Ser Asp Phe Pro Trp Asp Lys Val Lys Lys His Leu Gln Gly Ile Trp
 485 490 495

Phe Asn Thr Thr Val Ser Leu Asp Leu Leu Gln Leu His Asn Glu Ile
 500 505 510

Leu Asp Ile Glu Asn Ser Pro Lys Ala Thr Leu Asn Ile Ala Asp Thr
 515 520 525

Val Asp Asn Phe Leu Gln Asn Leu Phe Ser Asn Phe Pro Ser Leu His
 530 535 540

Ser Leu Trp Arg Ser Ile Ile Ala Met Gly Ala Val Leu Thr Val Val
 545 550 555 560

Leu Ile Ile Ile Cys Leu Ala Pro Cys Leu Ile Arg Ser Ile Val Lys

565

570

575

Glu Phe Leu His Met Arg Val Leu Ile His Lys Asn Met Leu Gln His
 580 585 590

Gln His Leu Met Glu Leu Leu Lys Asn Lys Glu Arg Gly Ala Ala Gly
 595 600 605

Asp Asp Pro
 610

<210> 18
 <211> 611
 <212> PRT
 <213> Ovis aries

<400> 18

Met Pro Lys Arg Arg Ala Gly Phe Arg Lys Gly Trp Tyr Ala Arg His
 1 5 10 15

Lys Asn Ser Leu Thr His Gln Met Gln Arg Met Thr Leu Ser Glu Pro
 20 25 30

Thr Ser Glu Leu Pro Thr Gln Arg Gln Ile Glu Ala Leu Met Arg Tyr
 35 40 45

Ala Trp Asn Glu Ala His Val Gln Pro Pro Val Thr Pro Thr Asn Ile
 50 55 60

Leu Ile Met Leu Leu Leu Leu Gln Arg Ile Gln Asn Gly Ala Ala
 65 70 75 80

Ala Ala Phe Trp Ala Tyr Ile Pro Asp Pro Pro Met Ile Gln Ser Leu
 85 90 95

Gly Trp Asp Lys Glu Thr Val Pro Val Tyr Val Asn Asp Thr Ser Leu
 100 105 110

Leu Gly Gly Lys Ser Asp Ile His Ile Ser Pro Gln Gln Ala Asn Ile
 115 120 125

Ser Phe Tyr Gly Leu Thr Thr Gln Tyr Pro Met Cys Phe Ser Tyr Gln
 130 135 140

Ser Gln His Pro His Cys Ile Gln Val Ser Ala Asp Ile Ser Tyr Pro
 145 150 155 160

Arg Val Thr Ile Ser Gly Ile Asp Glu Lys Thr Gly Lys Arg Ser Tyr
 165 170 175

Arg Asp Gly Thr Gly Pro Leu Asp Ile Pro Phe Cys Asp Lys His Leu
 180 185 190

Ser Ile Gly Ile Gly Ile Asp Thr Pro Trp Thr Leu Cys Arg Ala Arg
 195 200 205

Ile Ala Ser Val Tyr Asn Ile Asn Asn Ala Asn Thr Thr Leu Leu Trp
 210 215 220

Asp Trp Ala Pro Gly Gly Thr Pro Asp Phe Pro Glu Tyr Arg Gly Gln
 225 230 235 240

His Pro Pro Ile Leu Ser Val Asn Thr Ala Pro Ile Tyr Gln Thr Glu
 245 250 255

Leu Trp Lys Leu Leu Ala Ala Phe Gly His Gly Asn Ser Leu Tyr Leu
 260 265 270

Gln Pro Asn Ile Ser Gly Ser Lys Tyr Gly Asp Val Gly Val Thr Gly
 275 280 285

Phe Leu Tyr Pro Arg Ala Cys Val Pro Tyr Pro Phe Met Leu Ile Gln
 290 295 300

Gly His Met Glu Ile Thr Leu Ser Leu Asn Ile Tyr His Leu Asn Cys
 305 310 315 320

Ser Asn Cys Ile Leu Thr Asn Cys Ile Arg Gly Val Ala Lys Gly Glu
 325 330 335

Gln Val Ile Ile Val Lys Gln Pro Ala Phe Val Met Leu Pro Val Glu
 340 345 350

Ile Thr Glu Glu Trp Tyr Asp Glu Thr Ala Leu Glu Leu Leu Gln Arg
 355 360 365

Ile Asn Thr Ala Leu Ser Arg Pro Lys Arg Gly Leu Ser Leu Ile Ile
 370 375 380

Leu Gly Ile Val Ser Leu Ile Thr Leu Ile Ala Thr Ala Val Thr Ala
 385 390 395 400

Ser Val Ser Leu Ala Gln Ser Ile Gln Ala Ala His Thr Val Asp Ser
 405 410 415

Leu Ser Tyr Asn Val Thr Lys Val Met Gly Thr Gln Glu Asp Ile Asp
 420 425 430

Lys Lys Ile Glu Asp Arg Leu Ser Ala Leu Tyr Asp Val Val Arg Val
 435 440 445

Leu Gly Glu Gln Val Gln Ser Ile His Phe Arg Met Lys Ile Gln Cys
 450 455 460

His Ala Asn Tyr Lys Trp Ile Cys Val Thr Lys Lys Pro Tyr Asn Thr
 465 470 475 480

Ser Asp Phe Pro Trp Asp Lys Val Lys Lys His Leu Gln Gly Ile Trp
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Phe Asn Thr Asn Val Ser Leu Asp Leu Leu Gln Leu His Asn Glu Ile
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Leu Asp Ile Glu Asn Ser Pro Lys Ala Thr Leu Asn Ile Ala Asp Thr
 515 520 525

Val Asp Asn Phe Leu Gln Asn Leu Phe Ser Asn Phe Pro Ser Leu His
 530 535 540

Ser Leu Trp Gln Ser Ile Ile Ala Met Gly Ala Val Leu Thr Val Val
 545 550 555 560

Leu Ile Ile Ile Cys Leu Ala Pro Cys Leu Ile Arg Ser Ile Val Lys
 565 570 575

Glu Phe Leu His Met Arg Val Leu Ile His Lys Asn Met Leu Gln His
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Arg His Leu Met Glu Leu Leu Lys Asn Lys Glu Arg Gly Ala Ala Gly
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Asp Asp Pro
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 <213> Ovine pulmonary adenocarcinoma virus

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 <212> DNA
 <213> Ovine enzootic nasal tumour virus

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 <213> Ovis aries

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 <213> Ovis aries

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gttgagagtagtataat 135